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DATA ARCHIVAL

Logbook and international marine data recovery (e.g., RECLAIM)

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Summary and purpose of document

This document provides information on recent National activities to locate, image, and digitize data and metadata from historical ships' logbooks, focusing primarily on the RECovery of Logbooks And International Marine data (RECLAIM) Project.

ACTION PROPOSED

The Expert Team on Marine Climatology is invited to:

(a) Discuss ways to promote and enhance these important activities both nationally and internationally; and
(b) Consider recommendations to help quantify the added scientific value, and to help determine the prioritization, of ongoing and future digitization efforts, including possible new priorities outside of the World War II period for future United Kingdom digitization.

Appendices: A. Early European Ship Logs and the Climate Database Modernization Program (Meeting Report 2004)
B. RECLAIM website (hosted by US NOAA, under ICOADS)
C. Early and National Marine Metadata: Conferences, Codes, Formats, Ship Lists, and Instructions (Mr Scott Woodruff)

DISCUSSION

1. Background

The European, US, and other National archives still contain many thousands of, as yet, unexamined ships' logbooks. In hopes of improving efforts to detect climate change signals, and benefit other research reliant on the historical *in situ* marine records, efforts have accelerated in recent years to locate and digitize more meteorological observations from ships' logbooks (e.g., Elms, et al. 1993, Mierzejewska, et al. 1997, Diaz, et al. 1999, and Manabe 1999).

Most instrumental shipboard marine meteorological observations were recorded after the 1853 Brussels Maritime Conference (JCOMM 2004). That landmark Conference provided the initial international framework for reporting ships' observations, which has evolved into the JCOMM's contemporary VOS program. However, the European Union-funded "CLIWOC" project (García-Herrera, et al. 2005) also succeeded in digitizing and interpreting approximately 300K wind and other (mostly pre-instrumental textual) observations from the periods of 1750-1850, from British, Dutch, French, and Spanish logbooks.

As a consequence of these various activities, many new international datasets (see Figure 1) are in preparation for, or already await blending into, historical marine archives, most prominently the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) (Woodruff, et al. 2004, 2005).

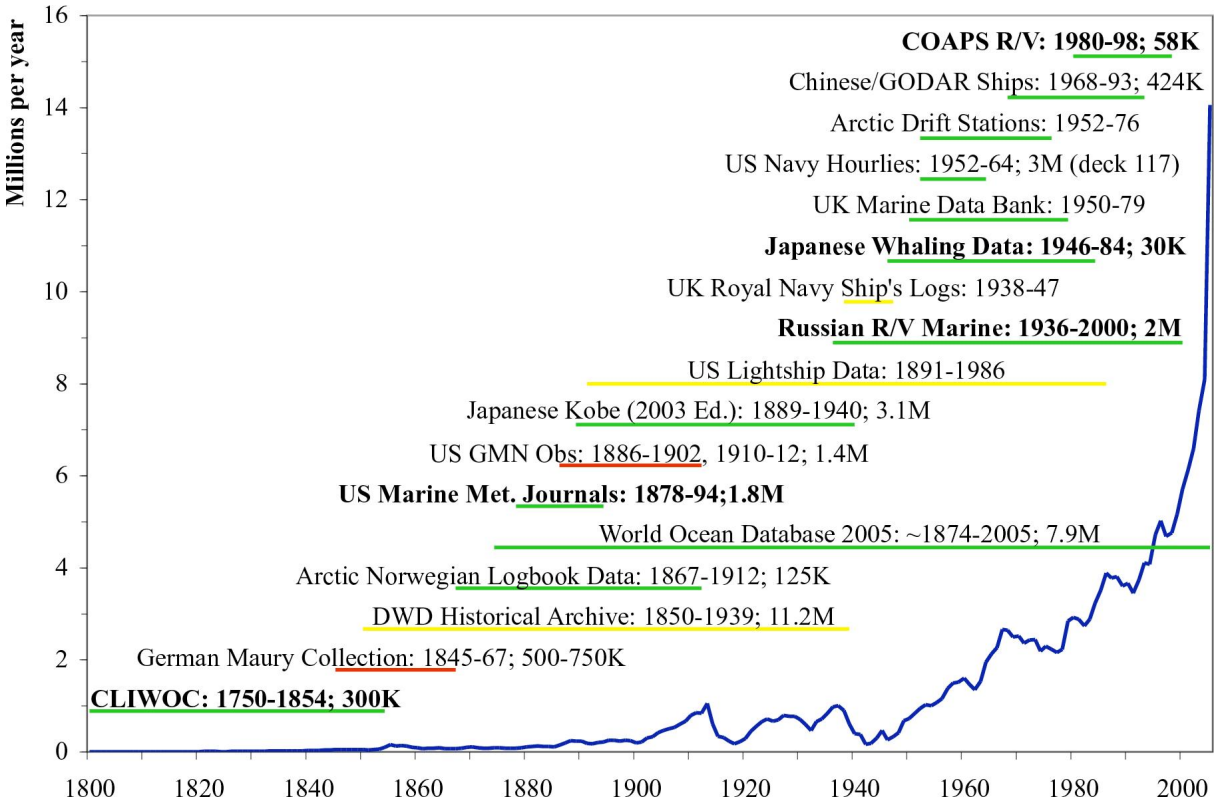

Figure 1. The time spans for candidate datasets to be blended into the ICOADS are shown by horizontal colored lines: green candidates are fully digitized but may need format translation and quality control (QC) work, yellow are partially digitized, and red are in the planning stages for digitization. Each dataset name is appended with the date range and approximate number of observations (if known). The solid curve is the number of observations in the current ICOADS (Release 2.3). Candidates in **bold face** are already available to the research community as "Auxiliary" ICOADS datasets, which means that they are standardized into the IMMA format including QC flags. Enhancement of the early marine record in the ICOADS is critical for a variety of climate research, including scientific assessments of global change, re-analyses, and validation of proxy data.

2. The NOAA Climate Database Modernization Program (CDMP)

A partnership between the US NOAA National Climatic Data Center (NCDC) and private industry, known as the CDMP, has provided significant funding and infrastructural resources, since the program's inception in 2000, for the general tasks of recovering, imaging, and/or digitizing[1] climate data records.

Tasks to date have included many important marine data and metadata (e.g., ETMC-II/Doc. 5.2), some of which could be subject to deterioration or loss in their original paper form. Recently, the program also began expanding its international connections, and, subject to the constraints of the NOAA budget, it is hoped that a reasonable ongoing level of activities in the marine area can continue to be funded.

The CDMP's contractor-developed Web Search Store Retrieve Display (WSSRD) software presently provides web-based access to the CDMP image collection for: the US government employees and their contractors, educational institutions doing environmental research, and other researchers associated with NOAA projects.

3. RECovery of Logbooks And International Marine (RECLAIM) data project

Following completion of the CLIWOC Project (2001-2003), a meeting was hosted by the NCDC, to develop new plans for keying additional logbooks from European, US, and other countries. The meeting brought together participants from Germany, Netherlands, Spain, United Kingdom, and USA. The Meeting concluded (see Appendix A) that the largest known un-digitized logbook holdings reside in the United Kingdom archives, with smaller, but still significant, amounts in Dutch, French, German, and other European archives. Considerable amounts of un-digitized data also still exist in US archives, including "Simultaneous" (Greenwich mean noon; GMN) marine observations for approximately 1886-1912 (see Figure 1), and US Navy logbooks which date back to 1801.

Among the Action Items from said meeting (which thus far have only been partially fulfilled) was to organize a new international project for imaging and digitizing data and metadata from historical ships' logbooks, including a website to be hosted under the ICOADS portal. This was undertaken in recognition that an international project focus could be helpful in seeking funding, and also to encourage participation by nations and by their archive institutions.

Consequently, the RECLAIM Project website (see Appendix B) was established in 2005, including presentations from the 2004 meeting. Since that time, the website has been more extensively populated with reference lists, rescued marine publications and documents (selected PDF files imaged by CDMP), plus inventories and other detailed documentation associated, so far, mainly with United Kingdom and US archives (e.g., Appendix C; see also Section 4).

One significant international task emerging from the RECLAIM project by 2006 was the imaging by KNMI, and storage on the WSSRD in 2006, of a collection of Dutch logbooks from the 19th century. These logbooks are planned for digitization by the CDMP, as resources permit. That task, plus a selection of other emerging RECLAIM or other potential international projects are listed in Table 1.

Table 1. Emerging RECLAIM or related potential international projects in 2005-2006 (non-UK).

[1] "Imaging" is ideally the first step to digitization. It is carried out to preserve hard copy (e.g., assuring that deteriorating paper or other media such as microfilm need be manipulated only once), with the results output into recognized archival image formats (e.g., PDF and TIF). "Digitization" of the relevant meteorological or oceanographic data (usually numeric, but sometimes in textual form) follows. This manual key entry (or sometimes automated Optical Character Recognition) process uses the images to create a data file in a digitization output format. These machinable data are then usually standardized into more uniform configurations and measurement units through a tertiary process of "translation" into archive formats (e.g., ETMC-II/Doc. 4.1). When blended with similarly formatted data, and adjusted for biases, they can serve as more homogeneous input to a wide variety of research, such as the search to quantify climate signals.

- Dutch 19th century logbooks (~170; 9K logbook pages) (F. Koek, Netherlands)
- French historical logbook microfilm records and documentation (R. García-Herrera, Spain)
- Canadian Hudson Bay Company (HBC) and N. American Royal Navy logbooks (V. Swail, Canada)
- Australian ships' logbooks (~1,300; 1855-1982) (Bill Wright, Australia; R. Allan, UK)
- New Zealand logbooks (e.g., 3K covering 1936-94) (C. Wilkinson, UK)
- South African (Capetown) logs and harbour master records (1820s-60s) (C. Wilkinson, UK; et al.)
- Norwegian (1785-1870) logbooks (A. Mjaland, Norway; C. Wilkinson, UK)
- Chinese Maritime Customs Project meteorological data (R. Bickers, UK; R. Allan, UK)

4. A focus on UK Archives

In recognition of the wide variety and estimated very large extent of the United Kingdoms holdings, plus complex logistical and archive access issues, a major RECLAIM project focus since 2005, has been on arrangements to select and image logbooks from UK archives. Clive Wilkinson (UK; also part of the original CLIWOC Team), working as a CDMP contractor, has written extensive background documentation on early logbook holdings available at four major UK archives: The National Archives (Kew) (TNA), National Maritime Museum (Greenwich), British Library (London), and Met Office (Exeter). In addition, Dr Wilkinson is developing detailed individual logbook inventories for selected historical periods, and concentrated at this stage on UK Royal Navy (RN) Ship's Logs held at TNA.

After a discussion of the potential scientific benefits, the initial thrust, in a jointly funded UK and CDMP effort, has been on imaging and digitization of a selected 250K pages of RN Ship's Logs around the data-sparse World War II period (see Figure 1). That selected imaging (spanning from 1938 to 1947), was completed in early 2006, and shipped to the CDMP for storage on WSSRD and digitization. To date, approximately 0.5M observations have been digitized, mostly from 1941 to 1943, which represent about one-third of the total (anticipated for completion in 2007).

As part of the World War II RN Project, efforts are also under consideration to locate associated ship instrumental metadata, which may be available separately. For example, some RN data (for World War II and other periods) have already been included in the ICOADS via the UK Marine Data Bank (MDB). However, the WW II MDB data are from quasi-independent "Met Logs" (archived at the Met Office), which may overlap the TNA Ship's Logs in data content, but include richer metadata. Regrettably, however, most of those metadata (including ship ID) were not keyed into the MDB, basically owing to the constraints of mid-20th century digitization practices and storage limitations (e.g., 80-character punched cards).

Finally, a variety of additional UK data and ancillary archives are also under investigation, which, together with other potential multi-disciplinary initiatives now emerging, might usefully be connected in the future with RECLAIM (Table 2).

Table 2. Emerging additional UK-focus projects or other new initiatives in 2005-2006.

- English East India Co. (EIC) instrumental logbooks (~2K; 1780-1800) (D. Wheeler, UK; et al.)
- Hull initiative: Whaling and other high-latitude logbooks (1790-1830) (D. Wheeler, UK; et al.)
- Exeter initiative: proposed 5-year multi-disciplinary project (R. Allan, UK; et al.)
- UK expeditionary meteorological tables/logbooks (e.g., *Challenger*; 1870s) (C. Wilkinson, UK)
- Early UK ship instrumental and platform metadata (e.g., published) (C. Wilkinson, UK)
- Compendium of UK national ship reporting practices and publications (similar to Appendix C)

5. Quantifying added scientific value and determining future priorities?

Moving beyond the UK WW II Project, and considering the wealth of international historical logbook data, potentially from countries not specifically mentioned in this report, an important but largely unresolved question has been how to assess the scientific value of digitizing and blending rescued data and metadata into climate databases, including the ICOADS, and other (e.g., historical) research databases.

Together with archival preservation (e.g., deteriorating paper or electronic media) requirements, better value assessments could help justify the often very large costs associated with imaging and digitization. Moreover, the relatively high costs of translating early marine meteorological data into the standardized ICOADS observational IMMA format, QC, and blending (e.g., complex duplicate elimination requirements) also need to be borne in mind (see Figure 1).

These cost and benefit questions factor into the challenge of developing new priorities for digitization projects (e.g., in relation to the likely somewhat competing requirements of proposed new cross-disciplinary studies, atmospheric re-analyses, and longer-term climate assessments for which, for example, seeking to address frequently uneven or non-existent sampling in large portions of the Southern Hemisphere is one high priority).

6. Connections with other international projects

- In February 2007, the GCOS AOPC/OOPC Surface Pressure Working Group (SPWG) wrote to Mr Reinhard Zöllner (Germany) regarding the possibility of exchanging as much historical marine archive, focused primarily on the period 1880-1948, with the ICOADS project from the Deutscher Wetterdienst (DWD) as possible. This would help support the 20th Century Reanalysis Project (Compo, et al., 2006) and also, via the ICOADS, feed into the SPWG's International Surface Pressure Data Bank (ISDP).

- Possible oceanographic connections are also being explored with the Global Oceanographic Data Archaeology and Rescue (GODAR) Project, and the World Ocean Database Project of the US NOAA National Oceanographic Data Center (see Figure 1).

- It should be emphasized that the ICOADS is recognized worldwide and freely available. It provides an ideal infrastructure to bring digitization results to the public for beneficial research and study.

7. Connections with other ETMC tasks

- The IMMA format (ETMC-II/Doc. 4.1), which, through the ICOADS, is already in widespread public use for climate and other research, was developed with the flexibility to store both contemporary and historical marine data and metadata, and to be relatively simple for Members to process and manipulate.

- Early national codes and marine observational instructions (see Appendix C) represent a precursor to the international standardization of codes and procedures under the International Meteorological Committee/Organization, and later under the WMO and JCOMM (ETMC-II/Doc. 4.2).

References

Compo G.P., J.S. Whitaker, and P.D. Sardeshmukh, 2006: Feasibility of a 100-year reanalysis using only surface pressure data. *Bull. Amer. Meteor. Soc.*, **87**, 175-190.

Diaz, H.F., and S.D. Woodruff (Eds.), 1999: *Proceedings of the International Workshop on Digitization and Preparation of Historical Surface Marine Data and Metadata (Toledo, Spain, 15-17 September 1997)*. WMO/TD-No.957, MMROA Report No. 43, World Meteorological Organization, Geneva, 114 pp.

Elms, J.D., S.D. Woodruff, S.J. Worley, and C. Hanson, 1993: Digitizing Historical Records for the Comprehensive Ocean-Atmosphere Data Set (COADS). *Earth System Monitor*, **4**(2), 4-10.

García-Herrera, R., P. Jones, D. Wheeler, G. Können, and M.R. Prieto (Guest Eds.), 2005: CLIWOC: Climatology of the World's Oceans, 1750-1850 (Special Issue). *Clim. Change*, **73**, 1-194.

JCOMM, 2004: *An International Seminar to Celebrate the Brussels Maritime Conference of 1853 – An Historical*

Perspective of Operational Marine Meteorology and Oceanography: Proceedings. WMO/TD–No. 1226 (JCOMM Technical Report No. 27)—CD-ROM.

Manabe, T., 1999: The digitized Kobe Collection, phase I: historical surface marine meteorological observations in the archive of the Japan Meteorological Agency. *Bull. Amer. Meteor. Soc.*, **80**, 2703-2715.

Mierzejewska, A.W., Z. Wu, R.E. Newell, and T. Miyashita, 1997: Japanese whaling ships' sea surface temperature 1946-84. *Bull. Amer. Meteor. Soc.*, **78**, 443-447.

Woodruff, S., J. Elms, R. Reynolds, R. Garcia, F. Guo, S. Worley, and T. Yoshida, 2004: Rescuing marine data. *World Climate News*, No. 25 (June 2004), WMO, Geneva, 10.

Woodruff, S. D., H. F. Diaz, S. J. Worley, R. W. Reynolds, and S. J. Lubker, 2005: Early ship observational data and ICOADS. *Climatic Change,* **73,** 169–194.

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Appendices: 3

Appendix A

Meeting Report (Revised 7 December 2005)
Early European Ship Logs and the Climate Database Modernization Program
NOAA National Climatic Data Center (NCDC), Asheville, NC, USA, 23-24 August 2004

A meeting was held 23-24 August at NCDC to discuss imaging and digitization activities for early ship data from European archives, proposed for funding from NOAA's Climate Database Modernization Program (CDMP). In part, this is planned as a continuation and expansion of the European Union-funded Climatological Database for the World's Oceans (CLIWOC) 1750-1854 project (completed in 2003), which focused on logbooks containing "semi-instrumental" (e.g., wind force) observations (García-Herrera, 2005). In addition, the scope of the effort will include untapped European (and other) logbooks extending well into the instrumental (mainly post-1853) era, such as during the data-sparse World War II period (see e.g., Woodruff et al., 2004).

Major discussion points and action items from the meeting:

1. Vast amounts of undigitized historical ship logs exist in UK archives, and smaller, but still significant, amounts exist in Dutch, French, German, and other European archives. Some logs extend back into the 16th century. Considerable amounts also still reside in US archives (e.g., Navy logs back to 1801).

2. One outcome from the meeting will be a detailed report documenting our current knowledge of national logbook holdings (plus negative information such as about the apparently lost Portuguese logs):

    a) Dutch and Danish (KNMI)
    b) German (Reinhard)
    c) Spanish, French, Portuguese, and Italian (Ricardo)
    d) UK (Dennis and Phillip)
    e) US (Scott and Joe)

The report will not necessarily be limited to early historical logs—the status of undigitized logs at least through 1949 and possibly until WMO (1963) Resolution 35, which inaugurated the routine keying and international exchange of logbook data, may also be relevant.
Action: submissions to Scott by the end of 2005.

3. An abbreviated summary of the meeting and of the detailed report will also be prepared, and possibly published.
Action: Scott to draft for input of group, after completion of item 2.

4. The group agreed to organize an international project (possible acronyms: IMADRID, RECLAIM), with a website to be hosted under ICOADS. The website will include the detailed and abbreviated reports (items 2-3), electronic presentations from the meeting, etc. The existence of an international project could be helpful to obtain funding.
Action: To be hosted under the ICOADS website, by the end of 2005.

5. Assuming CDMP continues to be adequately funded, FY2005 support of approximately $300K would be desirable to initiate the project (contract period: March 2005-February 2006), and with hopes for continued multi-year funding. However, in view of the constraints on the use of CDMP funding, other sources of funding will be investigated nationally (e.g., UK, Spanish) particularly for imaging tasks. Independently, Germany is proceeding with imaging and digitization of its own logbook holdings.
Action: CDMP and all.

Participants:

Philip Brohan, Hadley Centre, UK
Joe Elms, NOAA/NCDC
Ricardo Garciá-Herrera, U. Complutense, Spain
Gunther Können, KNMI
Dennis Wheeler, Sunderland U., UK
Scott Woodruff, NOAA/CDC
Steve Worley, NCAR
Reinhard Zöllner, DWD, Germany

References:

García-Herrera, R., G.P. Können, D.A. Wheeler, M.R. Prieto, P.D. Jones, and F.B. Koek, 2005: CLIWOC: A climatological database for the world's oceans 1750-1854. *Climatic Change*, **73**, 1-12.

Woodruff, S., J. Elms, R. Reynolds, R. Garcia, F. Guo, S. Worley, and T. Yoshida, 2004: Rescuing marine data. *World Climate News*, No. 25 (June 2004), WMO, Geneva, 10.

Appendix B

RECLAIM Website (hosted by US NOAA, under ICOADS)
http://icoads.noaa.gov/reclaim/

RECovery of Logbooks And International Marine data (RECLAIM) Project

Historical ships' logbooks, some from as early as the 17th century, are now being explored as an important source of additional climatic data. US and European scientists are working together to make the images, data, and metadata available on-line.

Project aim: A cooperative international project to image historical ship logbooks and related marine data and metadata, and digitize the meteorological and oceanographic observations for merger into the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) and for utilization for climate research.

Image credits

Note: links on this page may leave the RECLAIM web site.

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Updated: Jan 17, 2006 12:43:38 MST
http://icoads.noaa.gov/reclaim/index.html

Appendix C

Early and National Marine Metadata: Conferences, Codes, Formats, Ship Lists, and Instructions

Scott Woodruff, Revised 3 March 2007

1. Introduction

This report discusses various aspects of early and national marine metadata. The discussion is related to efforts to trace the history of the marine ship code (Yoshida, 2007). So far, those efforts have focused on locating WMO documentation, such as the *Manual on Codes* (WMO–No.306; earliest publication date unknown). However, national marine observing instructions even today play an important role, and were likely increasingly influential prior to the establishment of WMO (1950-51), and of its predecessor the International Meteorological Organization (1873). On the other hand, the landmark 1853 Brussels Maritime Conference marks the initiation point for most national observing instructions, even though some earlier instructions are known to exist (e.g., 1848; see Annex). Information about the formats (e.g., early punched card decks) in which marine data have been stored in national archives can also form important metadata. Note: References appear at the end of each section; references preceded by an asterisk (*) are available from NOAA's Climate Database Modernization Program (CDMP), and those preceded by a dagger (†) additionally from icoads.noaa.gov/reclaim/.

Yoshida, T., 2007: History of the marine ship codes. Document submitted to the second session of the JCOMM Expert Team on Marine Climatology (ETMC-II/Doc. 4.2), Geneva, 26-27 March 2007. [Note: see also: goos.kishou.go.jp/ws/ETMC/code_task/.]

2. Earliest maritime conferences

Reports (or the minutes of the proceedings) from the 1853 Brussels conference are available from sources such as Maury (1854), Quetelet (1854), and Maury (1858). Recommended observing instructions in the form of "Explanatory notes," and/or example log forms, are included in Maury (1851, 1854, 1858).

The 1874 Maritime Conference (1875) reviewed the recommended forms and codes from the Brussels Conference, and agreed on a variety of changes (the US and a few other invited countries did not attend the Conference, but submitted advance written comments). For example, it was recommended in 1874 that the direction and force of the wind be recorded as at the time of observation, rather than "that which has been most prevalent during the eight preceding hours," as was recommended at Brussels; and that cloudiness observations be switched to proportion (tenths) clouded, from proportion clear.

The 1874 Conference resolved to devise a "general form of Instructions to ensure uniformity in regard of methods of observation and registration," but also "modified to meet the requirements of different Nations." Also, it resolved to print for circulation among participating countries a set of detailed English instructions that forms part of the Conference proceedings.

†Maury, M.F., 1851: *Explanations and Sailing Directions to Accompany the Wind and Current Charts*, 3rd Ed., C. Alexander, Printer, Washington, 315 pp. + plates. [Note: Abstract log form on pp. 314-315.]

†Maury, M.F., 1854: *Explanations and Sailing Directions to Accompany the Wind and Current Charts*, 6th Ed., E.C. and J. Biddle, Philadelphia, 772 pp. + plates. [Note: A report from the 1853 Brussels Conference on pp. 54-60; "Minutes of the Sittings" on pp. 60-88; and "Explanatory notes for keeping the abstract log," and example log forms for men-of-war and merchantmen, on pp. 88-96.]

†Maury, M.F., 1855: *Explanations and Sailing Directions to Accompany the Wind and Current Charts*, 7th Ed., E.C.

and J. Biddle, Philadelphia, 869 pp. + plates. [Note: Material related to the 1853 Brussels Conference on pp. 181-212.]

Quetelet, A., 1854: Rapport de la Conférence, tenue à Bruxelles, sur l'invitation du gouvernement des Etats-Unis d'Amérique, à l'effet de s'entendre sur un système uniform d'observations météorologiques à la mer. *Annuaire de l'Observatoire Royal de Belgique*, **21**, 155-167. [Note: Report in French (a pdf based on a photocopy from the US Naval Observatory library is available); related material might follow on pp. 168-171.]

†Maury, M.F., 1858: *Explanations and Sailing Directions to Accompany the Wind and Current Charts*, 8th Ed., Vol. 1, W.A. Harris, printer, Washington, 383 pp. + plates. [Note: Material related to the 1853 Brussels Conference on pp. 330-383.]

†Maury, M.F., 1859: *Explanations and Sailing Directions to Accompany the Wind and Current Charts*, 8th Ed., Vol. 2, W.A. Harris, printer, Washington, 874 pp. + plates. [Note: Conditions upon which the Wind and Current Charts are furnished to navigators on pp. 870-874.]

†Maritime Conference, 1875: *Report of the Proceedings of the Conference on Maritime Meteorology held in London, 1874, Protocols and Appendices*. Published by Authority of the Meteorological Committee, Official No. 23, HM Stationery Office, London, 61 pp. [Note: "Proposed English instructions for keeping the meteorological log" are included on pp. 46-58, and an example log form appears on the following (unnumbered) page.]

3. Early history of the International Code

The full TDF-13 Reference Manual (AWS, 1960) otherwise concerns land data, but its section on the history of the international code has some relevance to marine codes (e.g., the code figures for wind direction and speed, DD and ff, date back to approximately 1912 and 1949, respectively). (CDMP plans to image the full TDF-13 Reference Manual, if it can be located.)

The 1948 Met Office publication resembles an early *Manual on Codes*. (The Met Office was contacted about this publication, and the Crown Copyright, of 50 years from date of publication, has expired.)

AWS (Air Weather Service), 1960: History of the International Code. *Reference Manual TDF 13*. HQ, Air Weather Service (1 September 1960), pp. 0.6-0.10 [Note: Available from NOAA/NCDC.]

*UK Meteorological Office, 1948: *International Meteorological Code Adopted by the International Meteorological Organization, Washington, 1947*. M.O. 509, H.M. Stationary Office, London, 39 pp.

4. Early US and UK card deck and format documentation

The Tape Data Family (TDF)-11 Reference Manual (NCDC, 1968) is a key format reference for early marine data included in ICOADS. In addition, although they are not listed individually here, CDMP has imaged all the original card deck reference manuals that it was able to locate, plus a set of similar early UK Met Office "Series" Manuals. (Note: marine reference manuals, including for the punched card decks used as input to TDF-11, the UK Series, and some marine decks that were destroyed many years ago, are available at icoads.noaa.gov/reclaim/).

†NCDC (National Climatic Data Center), 1968: *TDF-11 Reference Manual*. NCDC, Asheville, NC, 138 pp.

5. Early data sources: miscellaneous documentation

All the Kobe Collection data back to about 1890 were microfilmed under a joint project described by US Weather Bureau-JMA (1960, 1961) (note: only data from the period from 1933 forward were digitized into decks 118-119 during the 1960s).

†US Weather Bureau-JMA: 1960, *Guide Book of the Japanese Marine Surface Data*, US Weather Bureau and Japan Meteorological Agency, 527 pp.

†US Weather Bureau-Japan Meteorological Agency, 1961: *Guide Book of the Japanese Marine Surface Data*, US Weather Bureau and Japan Meteorological Agency, 81 pp.

†Verploegh, G.: 1966, Report of the Consultant on the Historical Sea-Surface Temperature Data Project, 49 pp. plus Annexes. [Notes: The Consultant was to, but the report appears not to have been archived by, WMO. Copies were obtained courtesy of the UK Met Office and KNMI.]

*WMO, 1985: User's Guide to the Data and Summaries of the Historical Sea Surface Temperature Data Project. WMO/TD–No.36, MMROA Report No. 13, World Meteorological Organization, Geneva.

6. Historical ship registers and lists

As was suggested at ETMC-I, for ships prior to the introduction of WMO–No.47 in 1955, some overall metadata (e.g., rigging, tonnage, dimensions, propulsion, and Master) could be obtained from sources such as Lloyd's Register of Shipping (some ships back to 1764):
www.lr.org

Or perhaps from on-line compilations based on Lloyd's and other sources, e.g.:
www.reach.net/~sc001198/Lloyds.htm
www.bruzelius.info/Nautica/Nautica.html

7. National observing instructions (except US)

Two editions of 19th century Norwegian observing instructions were translated to English by Erik Wishman (Woodruff et al., 1999), and are available in digital form (MS Word) but have not yet been made available on the web.

David Parker surveyed UK, US, and a variety of other foreign historical instructions publications, and had translated into English selections primarily focused on SST data. Several years ago David provided copies, or translations, of some observing instructions including Dutch (1866), German (1876, 1878) Italian (1912), Russian (1913), UK (1876, 1890, 1899). Some of these were referenced in Folland and Parker (1995), and an additional list of references exists (Parker, 1993). As discussed in sec. 2, the report from the 1874 Maritime Conference included "Proposed English instructions for keeping the meteorological log."

Folland, C.K. and D.E. Parker, 1995: Correction of instrumental biases in historical sea surface temperature data. *Q.J.R. Meteorol. Soc.*, **121**, 319-367.

Parker, D.E., 1993: Summary of information on sampling apparatus for sea surface temperature measurement. Hadley Centre Internal Note No. 34.

Woodruff, S., E. Wishman, F. Silva, S. Lubker, and M. Nitter, 1999: Incorporation of the Norwegian ship logbook collection into COADS, in Diaz, H.F. and Woodruff, S.D. (eds.), *Proceedings of the International Workshop on Digitization and Preparation of Historical Surface Marine Data and Metadata (Toledo, Spain, 15-17 September 1997)*. WMO/TD-No.957, MMROA Report No. 43, World Meteorological Organization, Geneva, pp. 99-103. [Note: pdf available from: icoads.noaa.gov/publications.html.]

8. US observing instructions

A partial reference list of US observing instructions appeared in Elms et al. (1993). The Annex provides an expanded list of known documents, of which portions as indicated have been imaged by CDMP.

The primary emphasis in creating the Annex was to seek out observing instructions for Voluntary Observing Ships issued by the Hydrographic Office and later by the Weather Bureau (now NOAA's National Weather Service; NWS). Even for this category there are some unresolved issues noted in the Annex, and it may be problematic to determine whether the list is complete (absent definitive records, e.g., of Hydrographic Office and Weather Bureau publications).
US Navy ships apparently have operated under separate guidelines, at least during most time periods. NARS (1978) states:

> "In the 1860s, after the Bureau of Navigation was created, American naval ships began using

> official printed logbooks. The Bureau designed the books, issued detailed instructions on their use […] and began to collect completed logbooks. Before this time there had been no systematic collection of logbooks by the Navy Department; many captains had destroyed the logbooks at the end of a voyage or retained them as personal property."

Thus a significant number of additional instructions should exist from the US Navy (and probably also from the US Coast Guard).

NARS (National Archives and Records Service), 1978: *List of Logbooks of U.S. Navy Ships, Stations, and Miscellaneous Units, 1801-1947.* Special List 44, available from the National Archives and Records Administration, Washington, 561 pp.

Elms, J.D., S.D. Woodruff, S.J. Worley, and C. Hanson, 1993: Digitizing Historical Records for the Comprehensive Ocean-Atmosphere Data Set (COADS). *Earth System Monitor*, **4**(2), 4-10. [Note: On-line version: icoads.noaa.gov/coads1a.html.]

Annex:

Chronological Lists of Known US Marine Observing Instructions

A. Maury's Abstract Logs and Explanatory Notes

Maury, M.F., 1848: *Abstract Log for the Use of American Navigators*. Prepared under the direction of Commodore Lewis Warrington, Chief of the Bureau of Ordnance and Hydrography, by authority of Hon. John Y. Mason, Secretary of the Navy, by Lieut. M.F. Maury, U.S.N., Superintendent National Observatory. C. Alexander, Printer, Washington, 10 pp. of Explanations. [Note: Available within the US Maury Collection; imaged by CDMP.]

†Maury, M.F., 1851, 1854, 1855, 1858-59: *Explanations and Sailing Directions to Accompany the Wind and Current Charts*, 3rd, 6th, 7th, and 8th Eds. [Note: Discussed in sec. 2. Whether the 1st (1847?), 2nd (unknown date?), 4th (1852), and 5th (1853) Eds. contain similar material has not been determined.]

[Maury, M.F.?], 1853: Abstract Log for the Merchant Service, 11 pp. [Note: Available within the German Maury Collection between indexed journal numbers 8168-8169; imaged by CDMP. "Explanatory notes for keeping the abstract log," and an example log for men-of-war (also recommended for the merchant service), resemble those in Maury (1854) (see sec. 2).]

Maury, M.F., 1855: *Physical Geography of the Sea*. 3rd Ed., Harper & Brothers, New York. [Note: pp. 271-274 document and briefly explain the abstract log forms for a man-of-war and for merchant service.]

B. Hydrographic Office Instructions

Wyman, R.H., 1877: *Revised instructions for keeping the ship's log-book and for compiling the new meteorological returns*. US Navy Hydrographic Office, Government Printing Office, Washington, 28 pp.

†US Hydrographic Office, 1878-: *Meteorological Journal Instructions*, Government Printing Office, Washington. [Notes: The full Journal collection, which has been imaged by CDMP, covers 1878-94. Instructions appear on pp. 5-17 of each Journal, with additional pages for illustrations, etc. Six examples of the Instructions, the earliest dated 1878, have been partially re-imaged by CDMP into high-quality PDFs; however, some original color pages remain to be imaged. Proposed English instructions included in the 1874 Maritime Conference proceedings (sec. 2) seem to have influenced the Journal Instructions, e.g., some illustrations are identical.]

*Page, J., 1901: *Instructions to the Voluntary Meteorological Observers of the U.S. Hydrographic Office*. Hydrographic Office No. 119, Government Printing Office, Washington, 39 pp. [Note: A 1903 edition of abbreviated "Instructions to Observers" (found attached to observational forms) refers to H.O. 119.]

Page, J., 1904: *Instructions to the Voluntary Meteorological Observers of the U.S. Hydrographic Office*. Hydrographic Office No. 119, Government Printing Office, Washington, 40 pp.

C. Weather Bureau/NWS Instructions

*Page, J., 1906: *Instructions to the Marine Meteorological Observers of the U.S. Weather Bureau*. [Circular M, 1st Ed.], Government Printing Office, Washington, 46 pp.

*Heiskell, H.L., 1908: *Instructions to the Marine Meteorological Observers of the U.S. Weather Bureau.* W.B. No. 397 [Circular M, 2nd Ed.], Government Printing Office, Washington, 48 pp.

*Heiskell, H.L., 1910: *Instructions to the Marine Meteorological Observers of the U.S. Weather Bureau.* W.B. No. 444 [Circular M], 3rd Ed., Weather Bureau, Washington, 68 pp.

*US Weather Bureau, 1925: *Instructions to Marine Meteorological Observers.* W.B. No. 866, Circular M, Marine Division, 4th Ed., Government Printing Office, Washington, 99 pp. [Note: Editions prior to the 4th were not issued as Circular M, and those prior to the 3rd Ed. did not have the edition identified.]

*US Weather Bureau, 1929: *Instructions to Marine Meteorological Observers.* W.B., No. 991 (issued November 1929), Circular M, Marine Division, 5th Ed., Government Printing Office, Washington, 80 pp.

*US Weather Bureau, 1938: *Instructions to Marine Meteorological Observers.* W.B. No. 1221 (issued January 1938), Circular M, Marine Division, 6th Ed., Government Printing Office, Washington, 120 pp.

*US Weather Bureau, 1941: *Instructions to Marine Meteorological Observers.* W.B. No. 1221 (issued June 1941), Circular M, 7th Ed., Government Printing Office, Washington, 114 pp.

*US Weather Bureau, 1948: *Instructions for Recording and Coding Marine Meteorological Observations in the New International Code, Effective January 1, 1949*. Provisional Edition, Weather Bureau, Washington, 36 pp. plus Appendix (xi pp.).

*US Weather Bureau, 1950: *Manual of Marine Meteorological Observations.* Circular M, 8th Ed., Government Printing Office, Washington, 100 pp.

*US Weather Bureau, 1954: *Manual of Marine Meteorological Observations.* Circular M, 9th Ed. (January 1954), Government Printing Office, Washington, 86 pp.

*US Weather Bureau, 1959: *Manual of Marine Meteorological Observations.* Circular M, 10th Ed. (January 1959), Government Printing Office, Washington, 127 pp. [Note: Revised at least twice: March 1960 to include Change No. 1, and September 1962 to include Change No. 2 (11 pp., available as a separate document from CDMP).]

*US Weather Bureau, 1963: *Manual of Marine Meteorological Observations.* Circular M, 11th Ed. (January 1963), Government Printing Office, Washington, 133 pp.

*US Weather Bureau, 1964: *Manual of Marine Meteorological Observations.* Circular M, 12th Ed. (March 1964), Government Printing Office, Washington, 133 pp.

US Weather Bureau, 1969: *Marine Surface Observations*. Weather Bureau Observing Handbook No. 1, 1st Ed. (Reprinted December 1970), Silver Spring, MD, 43 pp.

US National Weather Service, 1971: [Note: Cited in Elms et al., 1993; details unknown.]

US National Weather Service, 1982: *Marine Surface Weather Observations*. National Weather Service Observing Handbook No. 1, Silver Spring, MD. [Note: Cited in Elms et al., 1993; NCDC Library, QC871.4.WR no. 1.]

US National Weather Service, 1991: *Marine Surface Weather Observations*. National Weather Service Observing Handbook No. 1 (July 1991), Silver Spring, MD.

US National Weather Service, 1992: [Note: Cited in Elms et al., 1993; details unknown.]

US National Weather Service, 1995: *Marine Surface Weather Observations*. National Weather Service Observing Handbook No. 1 (August 1995), Silver Spring, MD.

US National Weather Service, 1999: *Marine Surface Weather Observations*. National Weather Service Observing Handbook No. 1 (August 1995 Ed., revised April 1999), Silver Spring, MD.

US National Weather Service, 2002: *Marine Surface Weather Observations*. National Weather Service Observing Handbook No. 1 (August 1995 Ed., revised July 2002), Stennis Space Center, MS.

US National Weather Service, 2004: *Marine Surface Weather Observations*. National Weather Service Observing Handbook No. 1 (July 2004), Stennis Space Center, MS. [Notes: pdf available from: www.nws.noaa.gov/om/marine/pub.htm. Inclusion of images from Environment Canada may preclude offering the publication (including earlier editions) for sale.]

D. Weather Bureau Miscellaneous Instructions

*Weather Bureau, 1931: *International Code for Radio Weather Reports from Ships*.

*Weather Bureau, 1933: *International Code for Radio Weather Reports from Ships*.

*Weather Bureau, 1938: *International Code for Radio Weather Reports from Ships*.

*Weather Bureau, 1940: *International Code for Radio Weather Reports from Ships*.

Weather Bureau, 1948a: *Instructions for Meteorological Personnel Assigned to Weather Ships*. W.B. No. 1362, Circular T (April 1948), 9th Ed., Weather Bureau, Washington. [Note: The inside cover identifies preceding editions published in 1940-46.]

*Weather Bureau, 1948b: *International Code for Radio Weather Reports from Ships (Effective 1 January 1949)*. W.B. No. 1046 (Revised), Government Printing Office, Washington, 24 pp.

National Weather Service, 1991: *Ships' Code Card*. National Weather Service Form No. WS TA B-0-7 (9-91). [Notes: Other editions of the (poster-sized) "Code Cards" were prepared as a supplement to Observing Handbook No. 1; a few are available at the NCDC Library.]

E. US Navy and Coast Guard Instructions

Bureau of Navigation, 1866: Directions for Keeping the Ship's Log. Summary Instructions in: National Archives and Records Service, 1978, *List of Logbooks of U.S. Navy Ships, Stations, and Miscellaneous Units, 1801-1947,* Special List 44, available from the National Archives and Records Administration, Washington, 559-562.

Bureau of Equipment, 1891: Directions for Keeping the Ship's Log. Circular Instructions, Bureau of Equipment, Navy Department, September 23, 1891. [From the National Archives and Records Administration.]

Coast Guard, c. 1940: Instructions for Keeping the Ship's Log. Ship's Log Book, Form 2610, Treasury Dept., US Coast Guard, 3-5.

US Navy, c. 1944: Instructions for Keeping the Ship's Log. [Note: In use for the approximate period 1 June 1944 through 1945.]

US Navy, [current?]: *United States Navy Manual for Ship's Surface Weather Observations*. NAVMETOCCOMINST 3144.1D.